HALACARIDAE OF THE GREAT BARRIER REEF LAGOON AND CORAL SEA: THE *COPIDOGNATHUS ORNATUS* GROUP (ACARINA: PROSTIGMATA: HALACARIDAE)

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Seven species of the *Copidognathus ornatus* group are recorded from coral reefs in the Coral Sea and the Great Barrier Reef lagoon, among them *Copidognathus ornatus* Bartsch, a species previously known only from the Moçambique channel, and *C. hawaiiensis* Bartsch, previously described from Hawaii. The other species, *C. adonis*, *C. barrierensis*, *C. emblematus*, *C. insularis*, *C. orarius* and *C. prideauxae*, are new to science. These represent the first record of the *ornatus* group from Australia. A key to species of the *ornatus* group is presented. ❑ *Copidognathus, Great Barrier Reef, Halacaridae, Acarina.*

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Among the predominantly marine mite family Halacaridae, *Copidognathus*, with over 300 known species, accounts for almost one third of all known species. Although cosmopolitan, *Copidognathus* reaches its highest diversity in tropical or subtropical waters where it is known to constitute up to 50% of the halacarid fauna (Bartsch, 1992). Many *Copidognathus* species have been assigned to species groups, of which the *ornatus* group (Bartsch, 1992, 1997) is one. It was previously known from only 4 species, *C. acanthoscelus* Bartsch, 1992, and *C. umbonatus* Bartsch, 1992, both from Hong Kong, *C. hawaiiensis* Bartsch, 1989, from Hawaii, and *C. ornatus* Bartsch, 1981, from the Moçambique Channel. That no species of this group were previously recorded from Australia can be attributed to the scarcity of halacarid collections along the tropical Australian coast. As the present paper shows, at least 7 species of the *ornatus* group are present in northeastern Australia.

METHODS

All material was collected by the author except where stated otherwise. Mites were cleared in lactic acid and mounted in PVA. Drawings were made with the aid of a camera lucida from compressed specimens. Abbreviations in descriptions: AD, anterior dorsal plate; AE, anterior epimeral plate; ds-1 to ds-6, dorsal idiosomal setae (excluding those on posterior epimeral plate) numbered in sequence from anterior to posterior; GA, genitoanal plate; glp-1 to glp-4, dorsal gland pores numbered in sequence from anterior to posterior; OC, ocular plate; PD, posterior dorsal plate; PE, posterior epimeral plate; P-2, P-3, P-4, second, third and fourth palp segments, respectively, counted from base of palp; sgs, subgenital seta(e); I-IV, leg I to leg IV. Additional abbreviations used in the illustrations are explained in the captions. All specimens with an accession number prefix QMS are deposited in the Queensland Museum's branch Museum of Tropical Queensland' in Townsville. Other depositories: ANIC, Australian National Insect Collection, Canberra (Australia); ZMH, Zoologisches Institut und Zoologisches Museum, Universität Hamburg (Germany).

SYSTEMATICS

Superfamily HALACAROIDEA Cunliffe, 1955
Family HALACARIDAE Murray, 1877

Copidognathus ornatus group

DIAGNOSIS. AD at least as wide as long; anteriorly developed into a short nose (Fig. 1); with one anterior and 2 posterior areolae consisting of pits that are surrounded in deeper cuticular layers by a ring of canaliculi (= rosette pores, Newell, 1947, fig. 205). OC with distinct posterior narrow tail; posterior to ds-2 with oblong medial areola. PD with pair of medial and pair of lateral costae, both pairs furnished with rosette pores except in *C. barrierensis* where only the medial pair carries rosette pores and the lateral costae are transformed into narrow non-porous ridges (Fig. 3A); posteriorly with glp-3 and glp-4. Palp segment P-2 lacking ventral cuticular spine. Legs with ventrolateral lamella or cuticular spines on telofemur (Fig. 2A-D); genu IV with 4 setae; telofemur IV without

ventral seta; tibiae I and III each with a bipectinate seta, tibia II with 2 and tibia IV either with none or one such seta.

DESCRIPTION (characters listed under diagnosis are omitted). Dorsal and ventral plates well developed (Fig. 1A). AD anterolaterally with pair of glp-1; ds-1 inserted on anteromedial margins of posterior areolae. OC anterolaterally with glp-2 at level of ds-2 or slightly anterior to ds-2, often obscured amidst a group of rosette pores (= lateral areola) that extends to the pore canaliculus on the lateral margin (Fig. 1F). PD distinctly longer than half of idiosoma; cuticle outside costae furnished with shallow pits, which in most species are arranged in groups that are separated by cuticular bars that form a reticulated pattern; medial costae slightly widened near glp-3; ds-3 on or near the anterolateral edge of plate; ds-4 anterior and ds-5 posterior to glp-3; distance between glp-3 and ds-5 less than between glp-3 and ds-4; ds-6 near posterior margin of plate. AE furnished with pits (Fig. 1B, right half), which are more or less clearly arranged within polygons and in deeper cuticular layers separate into minute canaliculi (Fig. 1B, left half); pair of epimeral pores and 3 pairs of setae; posterior margin usually concave (Fig. 1C), sometimes straight. PE with one dorsolateral and 3 ventral setae; anterior to leg III and leg IV insertions with ventrolateral rosette pore areola. GA with rosette pores posterolaterally, remainder of plate pitted. Female with 3 pairs of perigenital setae and one pair subgenital setae (Fig. 1H). Male with 4 subgenital setae, the anterior 2 pairs more delicate than the posterior 2 pairs (Fig. 1C). Rostrum gradually narrowing towards anterior (Fig. 1D), as long as or slightly shorter than gnathosomal base; one pair of maxillary setae at the gnathosomal base/rostrum interface, the other pair in anterior half of rostrum; gnathosomal base on either side with pitted areola, pits separating into canaliculi in deeper cuticular layers. Palp 4-segmented, slender; P-2 with one dorsal seta; P-3 lacking setae; P-4 with 3 setae in basal whorl. Legs shorter than idiosoma; chaetotaxy (trochanter - tibia): I 1-2-5-4-7, II 1-2-5-4-7, III 1-2-2-3-5, IV 0-2-2-4-5. Tarsus I with 3 ventral setae, the other tarsi without ventral setae (ventral parambulacral setae not counted). Tarsi I and II with solenidion in dorsolateral position. Paired claws on tarsus I smaller than on other tarsi. Empodial claw on tarsus I more clearly visible than those on other tarsi, which are either barely visible or absent. Paired claws on tarsus I smooth or with inconspicuous pecten, those on other legs more conspicuously pectinate (Fig. 2E).

REMARKS. Species that are somewhat similar to the *ornatus* group and possibly related are *C. costipora* Newell, 1984, *C. triareolatus* Newell, 1984, *C. tuberans* Newell, 1984 and *C. ganglionatus* Newell, 1984. However, unlike the *ornatus* group, they have a ventral seta on telofemur IV and lack a distinct tail on the ocular plates and are therefore excluded.

Copidognathus adonis sp. nov.
(Figs 1,2)

ETYMOLOGY. Latin, Greek, *adonis* = a beautiful youth beloved by Venus.

MATERIAL. HOLOTYPE: QMS105673, ♂, Coral Sea, Chilcott Islet, 16°56.51'S 150°00.4'E, 14 Sep. 1998, G.A. Diaz-Pulido, coarse sand at 1-14m. PARATYPES: Coral Sea: QMS105674 (1 ♂), QMS105675 (1 ♀), ANIC (1 ♀), ZMH (1 ♀), data as for holotype; QMS105676 (1 ♂), Willis Islet, ca. 16°18'S 149°58'E, 15 Sep. 1998, G.A. Diaz-Pulido, fine to medium coarse sand at 0-10m; QMS105677-105681 (5 ♀s), QMS105682-105685 (4 ♂s), ANIC (1 ♂), ZMH (1 ♂), Lihou Reef, ca. 17°25'S 151°40'E 22 July 1998, D. Fenner, sand at 7m; QMS105686 (1 ♀), Flinders Reef, ca. 17°43'S 148°26'E, July 1998, D. Fenner, sand; QMS105687/105688 (2 ♀s), North Flinders Reefs, East Ribbon Reef, 17°41.16'S 148°33.04'E, 3 July 1999, J.C. Otto, coarse sand at 10m; QMS105689 (1 ♀), QMS 105690 (1 ♂), Flinders Reef, near cay, 17°42.73'S 148°26.29'E, 2 Jul. 1999, coarse sand at 3m; QMS105691 (1 ♀), Flinders Reef, near cay, 17°42.73'S 148°26.29'E, 2 July 1999, A. Burja, coarse sand at 5m.

DESCRIPTION. *Male and Female.* Male idiosoma 320-352μm (holotype 323μm) long, female idiosoma 326-346μm long. AD with anterior areola more slender than the 2 posterior ones, the posterior areola not extending to glp-1 (Fig. 1A). OC with medial areola consisting of at least eight rosette pores (Fig. 1F,G), often with a gap posteriorly (Fig. 1E), not extending to lateral margin of plate; between lateral and medial areolae with faint reticulate ornamentation (Fig. 1E). PD with medial and lateral costae, all separated from each other anteriorly; lateral costae sometimes with gaps interrupting the line of rosette pores; medial costae on average 2 to 3 rosette pores wide, lateral costae usually one rosette pore, posteriorly in some places 2 rosette pores wide; reticulate ornamentation between costae becoming fainter towards posterior margin; glp-3 and glp-4 associated with medial costae; ds-4 in anterior half of plate. AE with concave posterior margin. PE with a group or

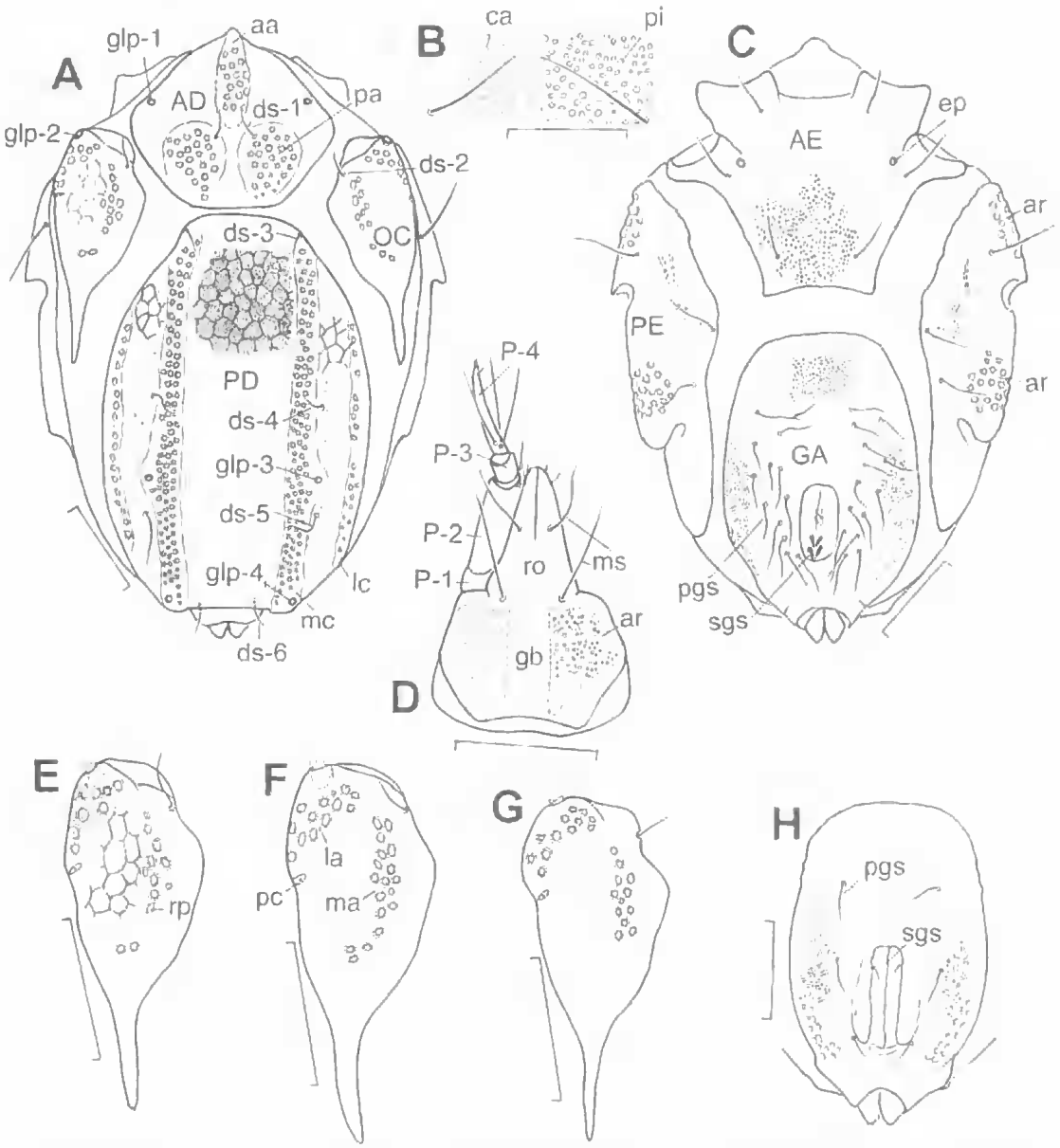

FIG. 1. *Copidognathus adonis* sp. nov., ♂. A, idiosoma, dorsal view; B, detail of anterior epimeral plate and posterior pair of setae; C, idiosma, ventral view; D, gnathosoma, ventral view; E-G, left ocular plate in 3 specimens; H, ♂ genitoanal plate. Abbreviations: aa, anterior areola; AD, anterior dorsal plate; AE, anterior epimeral plate; ar, areola; ca, canaliculi; ds-1 to ds-6, dorsal setae 1 to 6; ep, epimeral pore; gb, gnathosomal base; glp-1 to glp-4, gland pores 1 to 4; la, lateral areola; lc, lateral costa; ma, medial areola; mc, medial costa; ms, maxillary setae; OC, ocular plate; pa, posterior areola; pc, pore canaliculus; PD, posterior dorsal plate; PE, posterior epimeral plate; pgs, perigenital seta; pi, pits; P-1 to P-4, palp segments 1 to 4; ro, rostrum; rp, rosette pore; sgs, subgenital seta. Scale bars: A, C, D-H = 50μm; B = 25μm.

band of shallow pits in the anterior half from about the inner-most seta, this group not contiguous with anterolateral areola; posterior to leg IV insertions without canaliculi. Male with 27-30 perigenital setae. Gnathosoma as depicted in Fig. 1D. Ventrolateral lamellae on telofemora elaborate (Fig. 2A-D), with smooth or slightly undulate edge. Ventral margin of tibia I lacking a

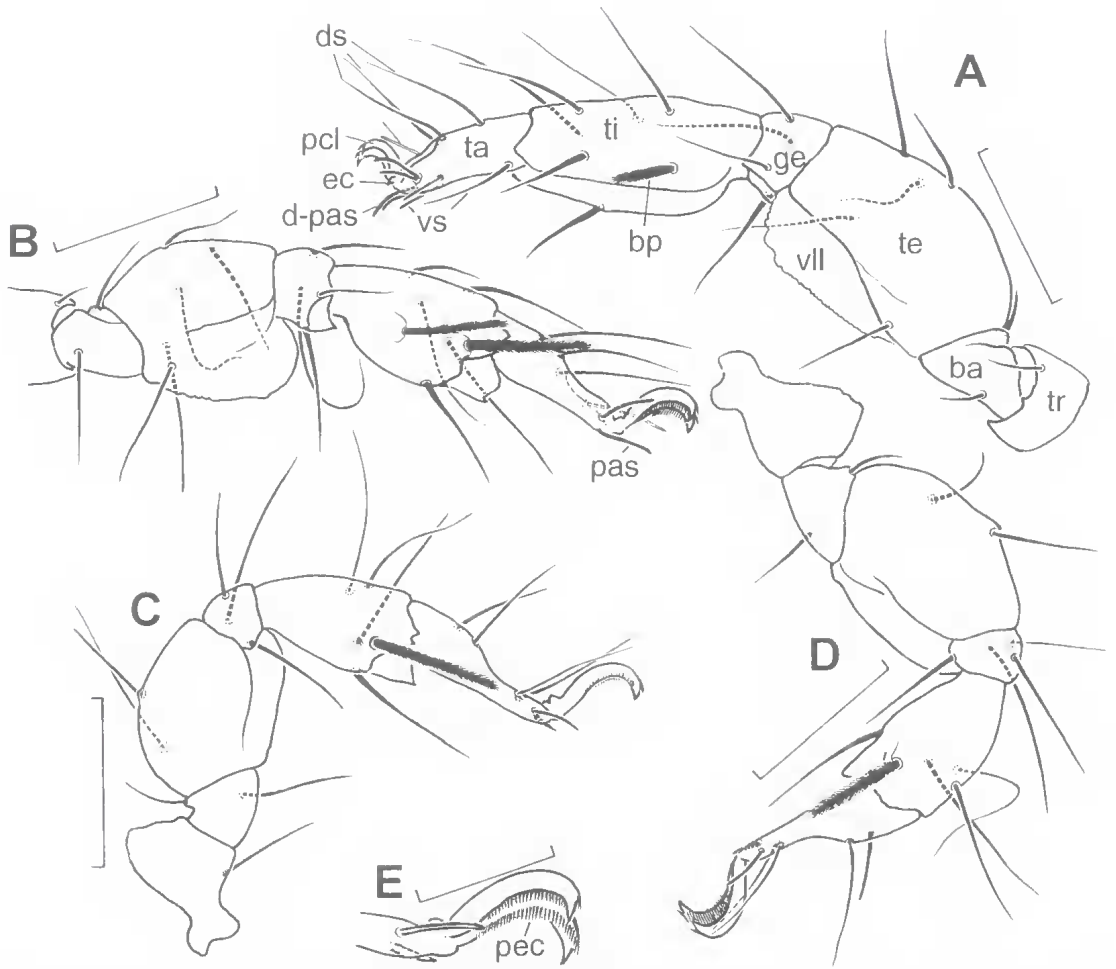

FIG. 2. *Copidognathus adonis* sp. nov., ♂; A, leg I, medial view; B, leg II, medial view; C, leg III, medial view; D, leg IV, medial view; E, claws of tarsus III, medial view. Abbreviations: ba, basifemur; bp, bipectinate seta; ds, dorsal setae; d-pas, doubled parambulacral seta; ec, empodial claw; ge, genu; pas, parambulacral seta; pcl, paired claw; pec, pecten; ta, tarsus; te, telofemur; ti, tibia; tr, trochanter; vs, ventral setae; vll, ventrolateral lamella; ω, solenidion. Scale bars: A-D = 50μm, E = 25μm.

conspicuous cuticular protuberance. Tibia IV with bipectinate seta. Bipectinate seta on tibia I as finely pectinate as those on other tibiae and not distinctly heavier than these. Tarsi III and IV each with 4 dorsal setae. Paired claws on tarsi II-IV with relatively fine pecten extending along the inside of the entire shaft (Fig. 2E, compare with Fig. 12E). Empodial claws on tarsi II-IV not clearly seen.

REMARKS. Other species of the *ornatus* group that have 4 setae on each of tarsi III and IV are *barrierensis*, *emblematus*, *orarius*, *ornatus* and *prideauxae*, all of which are described below.

Copidognathus barrierensis sp. nov.
(Figs 3,4)

ETYMOLOGY. From the Great Barrier Reef.

MATERIAL. HOLOTYPE: QMS105731, ♂, GBR, No Name Reef, ca. 14°39'S 145°40'E, 9 Oct. 1998, medium coarse sand at 6m. PARATYPES: GBR: QMS105732 (1 ♂), data as for holotype; QMS105692 (1 ♀), QMS105695 (1 ♀), QMS105693/ 105694 (2 ♂s), Loadstone Reef, 18°41.91'S 147°06.49'E, 12 Apr. 1998, sand & rubble at 2m; ANIC (1 ♀), ZMH (1 ♀), Loadstone Reef, 18°42.03'S 147°06.54'E, 12 Apr 1998, coarse sand & rubble at 12-15m; ZMH (1 ♂), ANIC (1 ♂), Loadstone Reef, 18°42.05'S 147°05.98'E, 12 Apr. 1998, coarse sand & rubble at 8m; QMS105696-105699 (4 ♀s), Faraday Reef, 18°25.93'S 147°21.11'E, 13 Apr. 1998, coarse sand

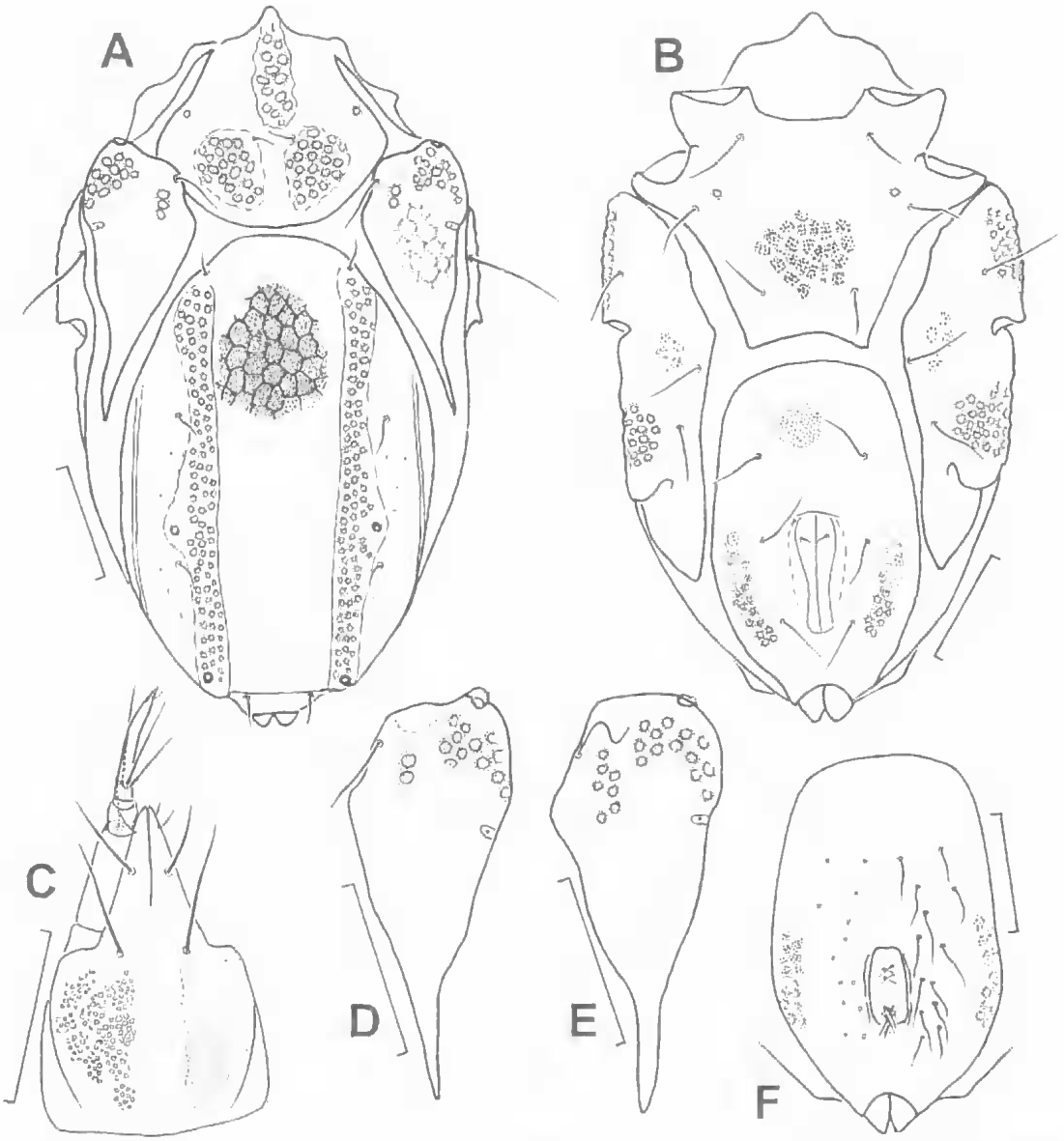

FIG. 3. *Copidognathus barrierensis* sp. nov.; A, ♀, idiosoma, dorsal view; B, ♀, idiosoma, ventral view; C, gnathosoma, ♀, ventral view; D,E, ocular plate of 2 ♀s; F, ♂, genitoanal plate. Scale bars: A-F = 50µm.

& rubble at 6-9m; QMS105700 (1 ♂), QMS105701 (1 ♀), Bramble Reef, 18°25.25'S 146°40.65'E, 10 Apr. 1998, medium coarse sand at 3-6m; QMS105702 (1 ♂), QMS105703 (1 ♀), Bramble Reef, 18°26.36'S 146°42.24'E, 9 Apr. 1998, coarse sand at 5m; QMS105704 (1 ♂), Turner Cay, NE, ca. 21°43'S 152°33'E, 8 Dec. 1998, medium coarse sand at 3m; QMS105705 (1 ♀), Howard Patch, ca. 22°23.5'S 152°37'E, 6 July 1998, D. Fenner, sand at 6m; QMS105706 (1 ♀), 23°12.22'S 151°58.49'E, 27 Aug. 1999, coarse sand at 60m, I. Zagorskis; QMS105707 (1 ♀), Myrmidon Reef, 18°16.69'S 147°23.21'E, 14 Apr 1998, coarse sand at 12m; QMS105708 (1 ♂), Elizabeth Reef, 19°20.12'S 149°02.85'E, 25 Dec. 1997, coarse sand & rubble at 3m; QMS105709 (1 ♂), Faraday Reef, 18°24.87'S 142°20.79'E, 12 Apr. 1998, on sponge at 10m; QMS105710-105711 (2 ♀s), Lavers Cay, 21°13'S 151°59'E, 20 Apr. 1999, chunks of coral rubble just above low tide mark, sediment depth 0-10cm; QMS105712 (1 ♂), Boulder Reef, ca. 15°24'S 145°27'E, 8 Oct. 1998, A. Thompson, coarse sand at 2m; QMS105713 (1 ♀), Lizard Island, Coconut Beach, ca. 14°40'S 145°28'E, 13 Oct. 1998, medium coarse sand at 0.5m.

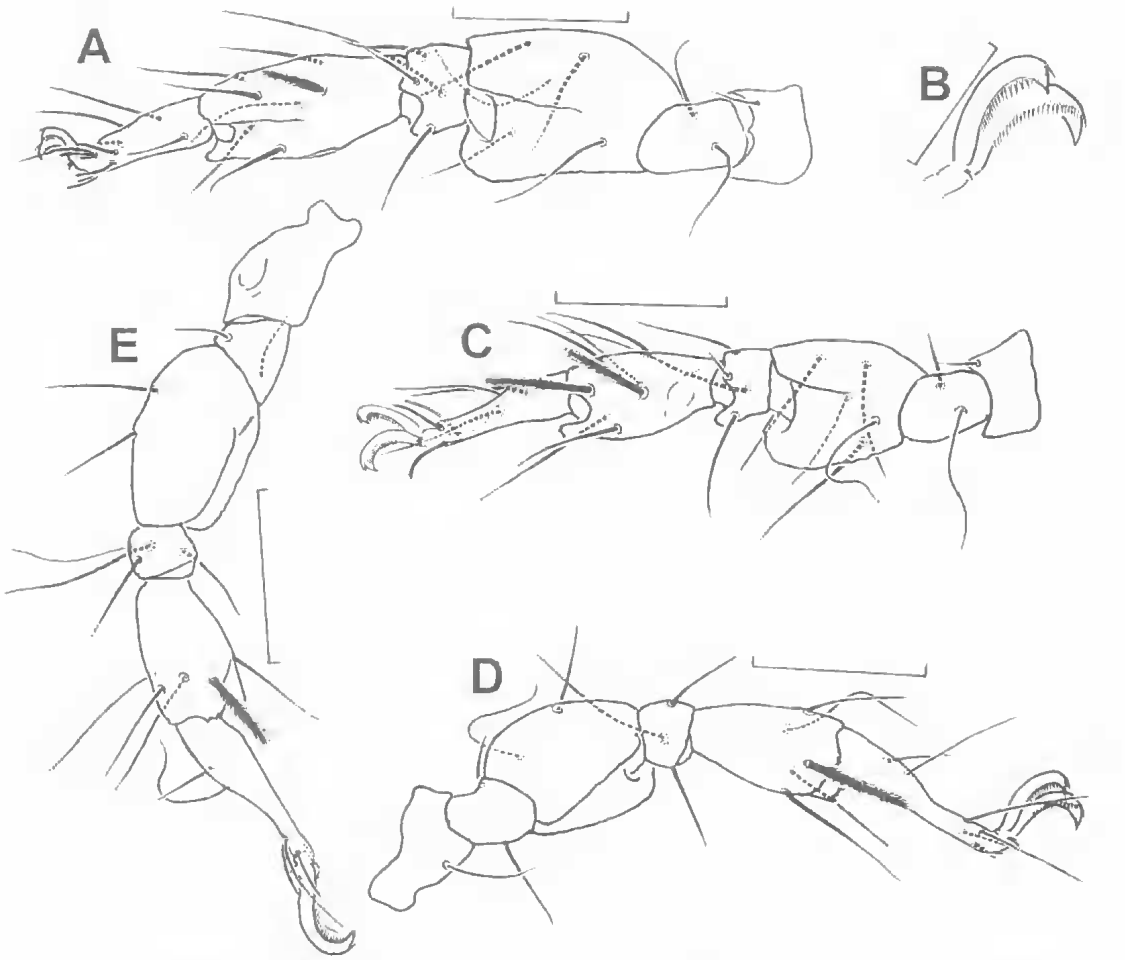

FIG. 4. *Copidognathus barrierensis* sp. nov., ♀. A, leg I, ventromedial view; B, claws on tarsus II, ventromedial view; C, leg II, ventromedial view; D, leg III, medial view; E, leg IV, medial view. Scale bars: A, C-D = 50μm; B = 25μm.

DESCRIPTION. *Male and Female*. Male idiosoma 313-326μm (holotype 326μm), female idiosoma 298-326μm long. AD with anterior areola more slender than the 2 posterior ones; posterior areolae not extending to glp-1 (Fig. 3A). Medial areola (Fig. 3A,D,E) on OC with usually 2-3, maximally 5 rosette pores; between lateral and medial areola faintly reticulate. PD with pair of porous medial costae (2-3 rosette pores wide), and pair of narrow non-porous lateral costae in form of a narrow ridge; glp-3 and glp-4 associated with medial costa; ds-4 on anterior half of plate; between costae with conspicuous reticulated ornamentation that becomes fainter towards posterior. AE with concave posterior margin (Fig. 3B). PE in anterior half close to inner margin with a group or band of shallow pits, this group or band not contiguous with the anterolateral areola. Male with 23-30 perigenital setae. Ventrolateral lamella on telofemora elaborate, with smooth or slightly undulate edges (Fig. 4A,C-E). Tibia IV with bipectinate seta. Bipectinate seta on tibia I as finely pectinate as those of other tibiae and not heavier than these. Tarsi III and IV with 4 dorsal setae. Paired claws of tarsi II-IV finely pectinate along most of shaft (Fig. 4F). Empodial claw on tarsi II-IV barely visible.

REMARKS. *Copidognathus barrierensis* can be distinguished from all other species in the *ornatus* group by having the lateral costae on the PD transformed into narrow non-porous ridges. In all other species in the group the lateral costae are furnished with rosette pores. A further

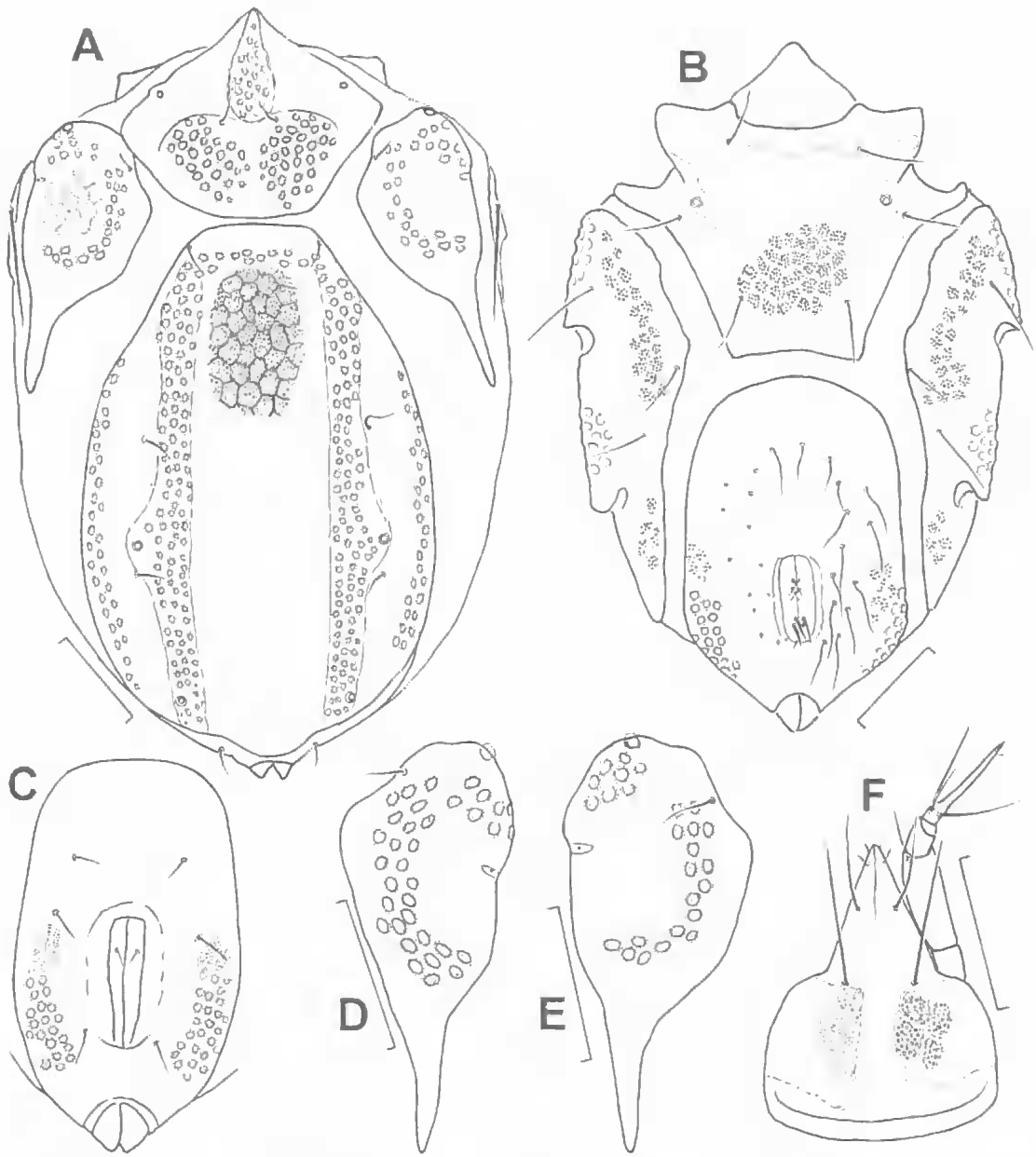

FIG. 5. *Copidognathus emblematus* sp. nov. A. ♂, idiosoma, dorsal view; B, ♂, idiosoma, ventral view; C, ♀, genitoanal plate; D,E, ocular plates in 2 ♂s; F, ♀, gnathosoma, ventral view. Scale bars: A-F = 50μm.

character by which it can be identified is the relatively short medial areola on the OC that has fewer rosette pores than any other species in the *ornatus* goup.

Copidognathus emblematus sp. nov.
(Figs 5,6)

ETYMOLOGY: Greek, *emblematus* = ornament.

MATERIAL. HOLOTYPE: QMS105714, ♂, GBR, Lizard Island, Coconut Beach, ca. 14°40'S 145°28'E, 13 Oct. 1998, medium coarse sand at 0.5m. PARATYPES: Great Barrier Reef: QMS105715 (1 ♂), ANIC (1 ♂), ZMH (1 ♂), data as for holotype; QMS105716 (1 ♂), Lizard Island, Coconut Beach, ca. 14°40'S 145°28'E, 13 Oct. 1998, medium coarse sand at mid-tide level, sediment depth 10cm; QMS105717 (1 ♂), Elizabeth Reef, 19°20.12'S 149°02.85'E, 25 Dec. 1997, coarse sand &

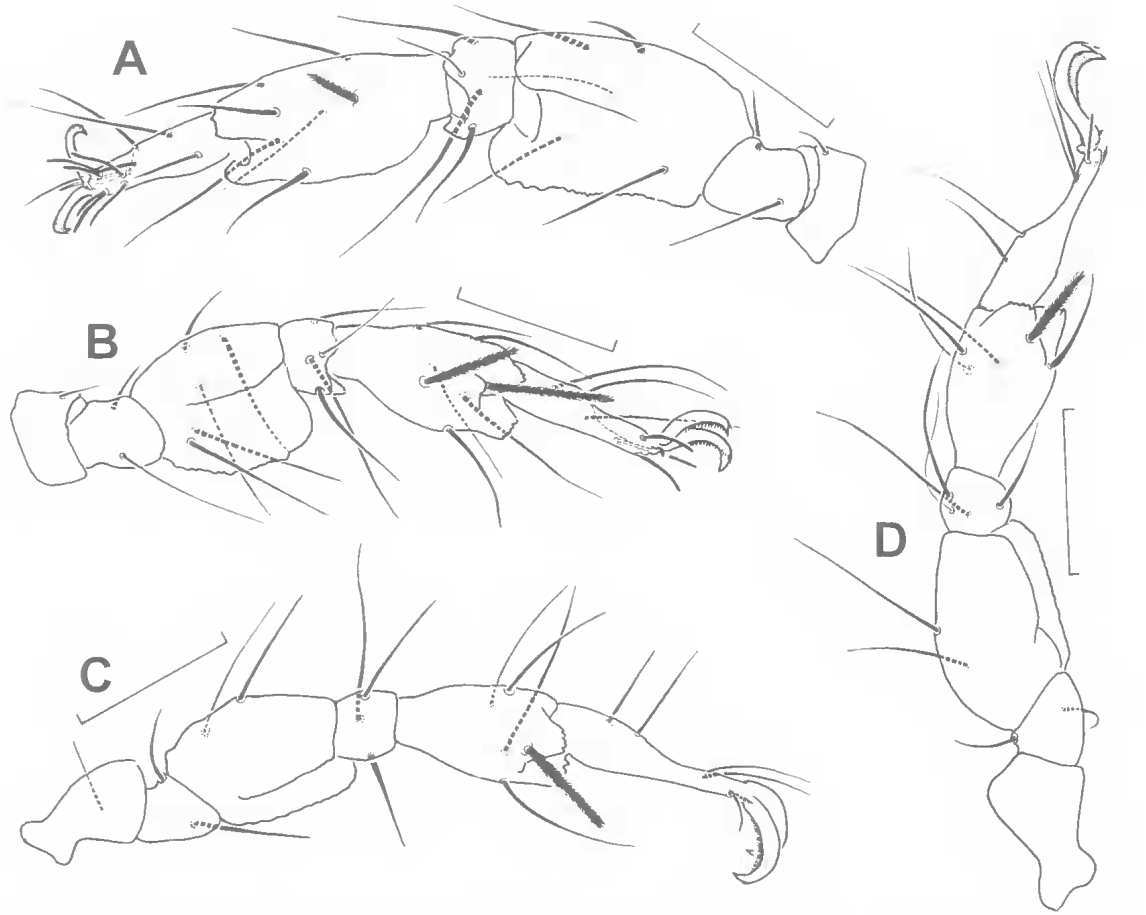

FIG. 6. *Copidognathus emblematus* sp. nov., ♂. A, leg I, ventromedial view; B, leg II, ventromedial view; C, leg III, medial view; D, leg IV, medial view. Scale bars: A-D = 50μm.

rubble at 3m; QMS105718 (1 ♂), John Brewer Reef, 18°38.25'S 147°04.42'E, 11 Apr. 1998, coarse sand at 15m; ANIC (1 ♀), ZMH (1 ♀), QMS105719-105721 (3 ♂s), East Cay, 21°29'S 152°33'E, 18 Apr. 1999, reef flat, coarse sand; QMS105722-105725 (4 ♂s), QMS105726/105727 (2 ♀s), Boulder Reef, ca. 15°24'S 145°27'E, 8 Oct. 1998, A. Thompson, coarse sand at 2m; QMS105728 (1 ♀), Reef 22-101, 21°02.5'S 151°30'E, 16 Apr. 1999, reef flat at 1m; QMS105729 (1 ♂), Turner Cay, 21°43'S 152°33'E, reef flat, 17 Apr. 1999, coarse sand at 2m.

DESCRIPTION. *Male and Female*. Male idiosoma 326-374μm long (holotype 352μm), female idiosoma 346-368μm long. AD with anterior areola more slender than the 2 posterior ones; posterior areolae not extending to glp-1. OC (Fig. 5A,D,E) with medial areola consisting of at least 15 rosette pores; both areolae in some specimens barely separated (Fig. 5D); between areolae with faint reticulate ornamentation. PD with pair of medial and pair of lateral costae, medial costae 2-3 rosette pore wide, lateral costae 1-2 rosette pore wide; medial costae either connected anteriorly by a transverse band of rosette pores (variable width between specimens, in some specimens only one rosette pore, in others 2-3 rosette pores wide) or both costae completely separate; between costae with reticulated ornamentation, gradually becoming fainter towards posterior; glp-3 and glp-4 associated with medial costae; ds-4 on anterior half of plate. AE with slightly concave posterior margin. PE in anterior half close to inner margin with a band of pits and underlying canaliculi that is contiguous with the anterolateral rosette pore areola (Fig. 5B); further groups of canaliculi posterior to insertions of leg IV. Male with 26-29 perigenital setae. Ventrolateral lamella on telofemora elaborate, with smooth or slightly undulate edges (Fig. 6A-D). Tibia IV with

bipectinate seta. Bipectinate seta on tibia I as finely pectinate as those on other tibiae and not heavier than these. Tarsi III and IV with 4 dorsal setae. Paired claws of legs II-IV finely pectinate. Empodial claws on tarsi II-IV barely visible.

REMARKS. The combination of 4 dorsal setae on tarsi III and IV and 4 porous costae on the PD is present also in *C. adonis*, *C. prideauxae* and *C. ornatus*, all of which are described below. *Copidognathus emblematus* can be distinguished from *C. adonis* by having groups of canaliculi on the PE posterior to leg IV insertions and by having a broad band of pits and underlying canaliculi arising from anteromedial areola on the PE. A group or band of shallow pits in the anterior half of the PE is also present in *C. adonis*. However, in the latter species, these are not contiguous with the anterior rosette pore areola on the PE, as is the case in *C. emblematus*. A further difference between both species is in the ornamentation along the anterior margin of the PD. In *C. emblematus* a transverse band of rosette pores connecting both medial costae anteriorly was found in some but not all specimens, while in *C. adonis* it was absent in all specimens. It follows that presence of a transverse band identifies *C. emblematus* while absence of a transverse band is inconclusive. It is interesting to note that the transverse band was absent only in *C. emblematus* specimens specimens collected on the most southerly sites, south of 21°S (East Cay, Reef 22-101, Turner Cay).

Differences between *C. emblematus*, *C. orarius* and *C. prideauxae* are discussed under the remarks to the latter species.

Copidognathus hawaiiensis Bartsch, 1989
(Figs 7,8)

Copidognathus hawaiiensis Bartsch, 1989: 141.

MATERIAL. Australia, GBR: QMS105742 (1 ♀), Morris Island, 13°29'S 143°44'E, 18 Aug. 1999, C. Bastidas, K. Fabricius & S. Uthicke, fine- medium coarse sand; QMS105743 (1 ♂), Whitsunday Islands, Long Island, ca. 20°23'S 148°52'E, 28 Feb, 1997, sand at 0.5 m. Indonesia, Bali: QMS105744 (1 ♂), QMS105745 (1 ♀), Menjangan Island, 9 Mar. 1999, J. Benzie, coarse-fine sand in 0.3-0.5m water depth.

DESCRIPTION. *Male and Female* (listed material only). Idiosoma in Australian and Indonesian males 352μm and 314μm, respectively, in Australian and Indonesian females 314μm and 310μm, respectively. AD with posterior areolae extending to glp-1; along posterior margin with a band of rosette pores (Fig. 7A). Medial areola on OC with at least 11 rosette pores; remainder of plate with scattered shallow pits. PD with 2-4 rosette pore wide medial and lateral costae, all conntected anteriorly; no reticulation seen between costae. Pores glp-3 in lateral costa, glp-4 in medial costa; ds-4 in anterior half of plate. AE with straight or concave posterior margin (Fig. 7B); PE with rosette pores posterior to leg IV insertions. Male with ca. 20-24 perigenital setae. Telofemur I with ventrolateral lamella transformed into 2 conspicuous protuberances (Fig. 8A), on one side of a specimen with an additional protuberance (Fig. 8E); a cuticular spine distally on medial flank. Tibia I with one ventral and one smaller distomedial protuberance, each associated with a seta. Telofemur I conspicuously pitted on lateral flank (Fig. 8F). Tibia IV with bipectinate seta. Bipectinate seta on tibia I more robust than those on other segments. Tarsi III and IV with 3 dorsal setae. Empodial claw on tarsi II-IV clearly visible. Paired claws of tarsus I smooth, those on tarsi II-IV with moderately coarse pecten over most of the shaft.

REMARKS. I have been unable to find any taxonomically important differences between the Hawaiian type and the Australian or Indonesian material listed above, and conclude that these are conspecific. Thus, *C. hawaiiensis* is the third halacarid species that is known to occur in Hawaii as well as the Great Barrier Reef. The other 2 are *Acarochelopodia biunguis* Bartsch (Otto, 2000b) and *Scaptognathus kunzi* Bartsch (Otto, 2000a). The common occurrence of these species on both the Hawaiian archipelago and the Great Barrier Reef is noteworthy, as Halacaridae in general have poor dispersal ability and areas that are separated by large and deep bodies of water therefore usually have different halacarid faunas.

C. hawaiiensis is similar to *C. acanthoscelus* Bartsch, 1992, in having the ventrolateral lamella on telofemur I transformed into spines and in having a conspicuous ventral protuberance on tibia I that is associated with a seta. *C. acanthoscelus* differs from *C. hawaiiensis* in that the spines on telofemur I are more numerous and in the glp-3 being associated with the medial instead of the lateral costae on the PD.

Copidognathus orarius sp. nov.
(Figs 9,10)

ETYMOLOGY. Latin, *orarius* = of the coast.

MATERIAL. HOLOTYPE: QMS105735, ♂, Great Barrier Reef, Taylors Beach, near Lucinda, ca.18°37'S

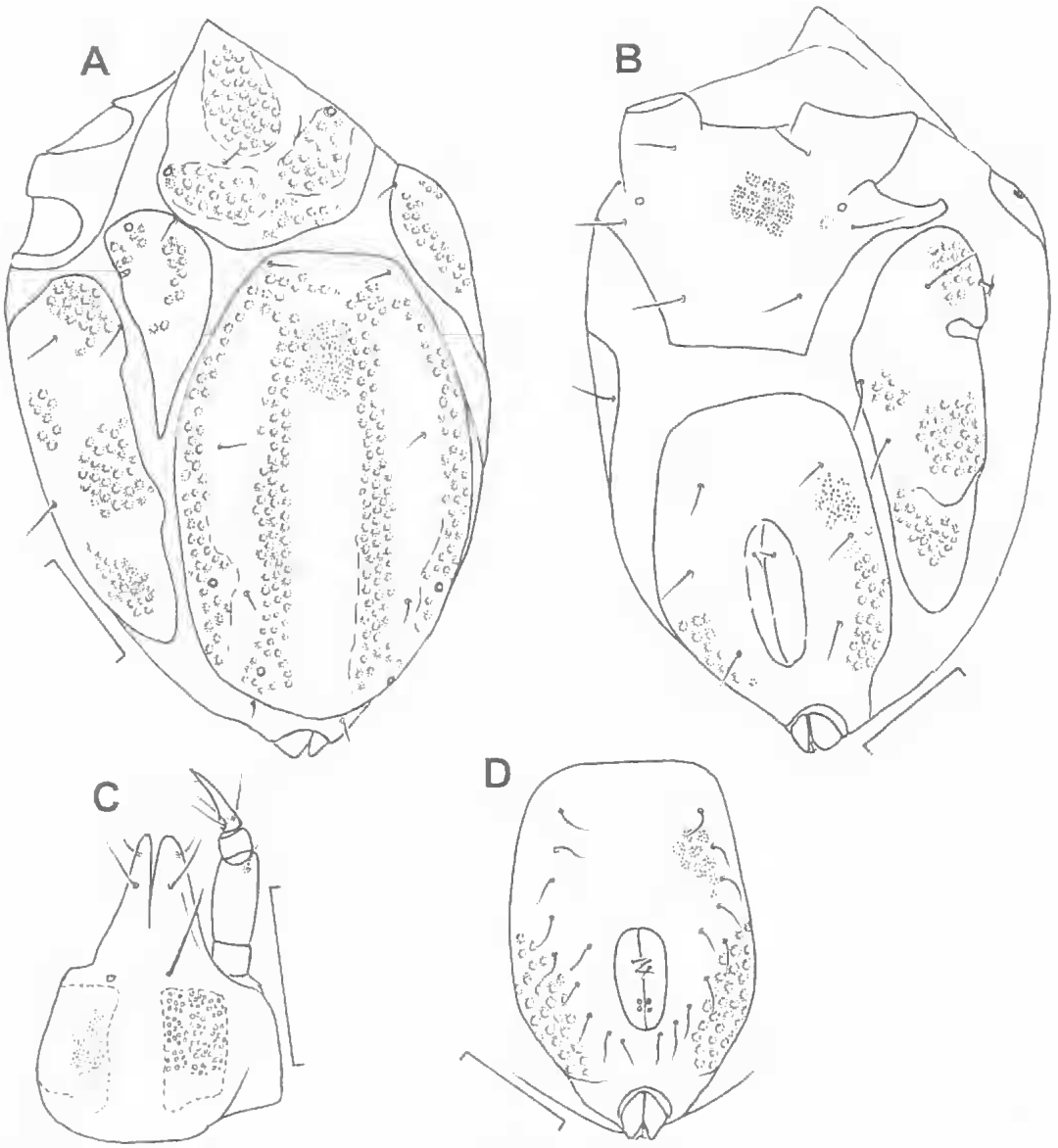

FIG. 7. *Copidognathus hawaiiensis* Bartsch; A, ♀, idiosoma, dorsolateral view; B, ♀, idiosoma, ventrolateral view; C, ♀, gnathosoma, ventral view; D, ♂, genitoanal plate. Scale bars: A-D = 50μm.

146°20'E, 14 Dec 1997, medium coarse sand just above low tide mark, sediment depth 0-5cm. PARATYPES: ANIC (1 ♀), ZMH (1 ♀), QMS105733/105734 (2 ♀s), ANIC (1 ♂), ZMH (1 ♀), QMS105736-05740 (5 ♂s), data as for holotype. OTHER MATERIAL: QMS105741 (1 ♂), Indonesia, Bali, Menjangan Island, 9 Mar., 1999, J. Benzie, coarse-fine sand in 0.3-0.5m water depth.

DESCRIPTION. *Male and Female.* Idiosoma in Australian and Indonesian males 288-307μm (holotype 307μm) long and 278μm long, respectively, in Australian females 282-304μm long. AD with distinctly blunt nose (Fig. 9A); posterior areolae extending to glp-1; along posterior margin with band of rosette pores; cuticle between areolae with scattered pits. OC with medial areola consisting of at least 15 rosette pores and extending to lateral margin of plate; remainder of plate with scattered pits. PD with medial and lateral costae, all connected anteriorly; lateral areola on average 2 rosette pores wide; medial areola increasing in width

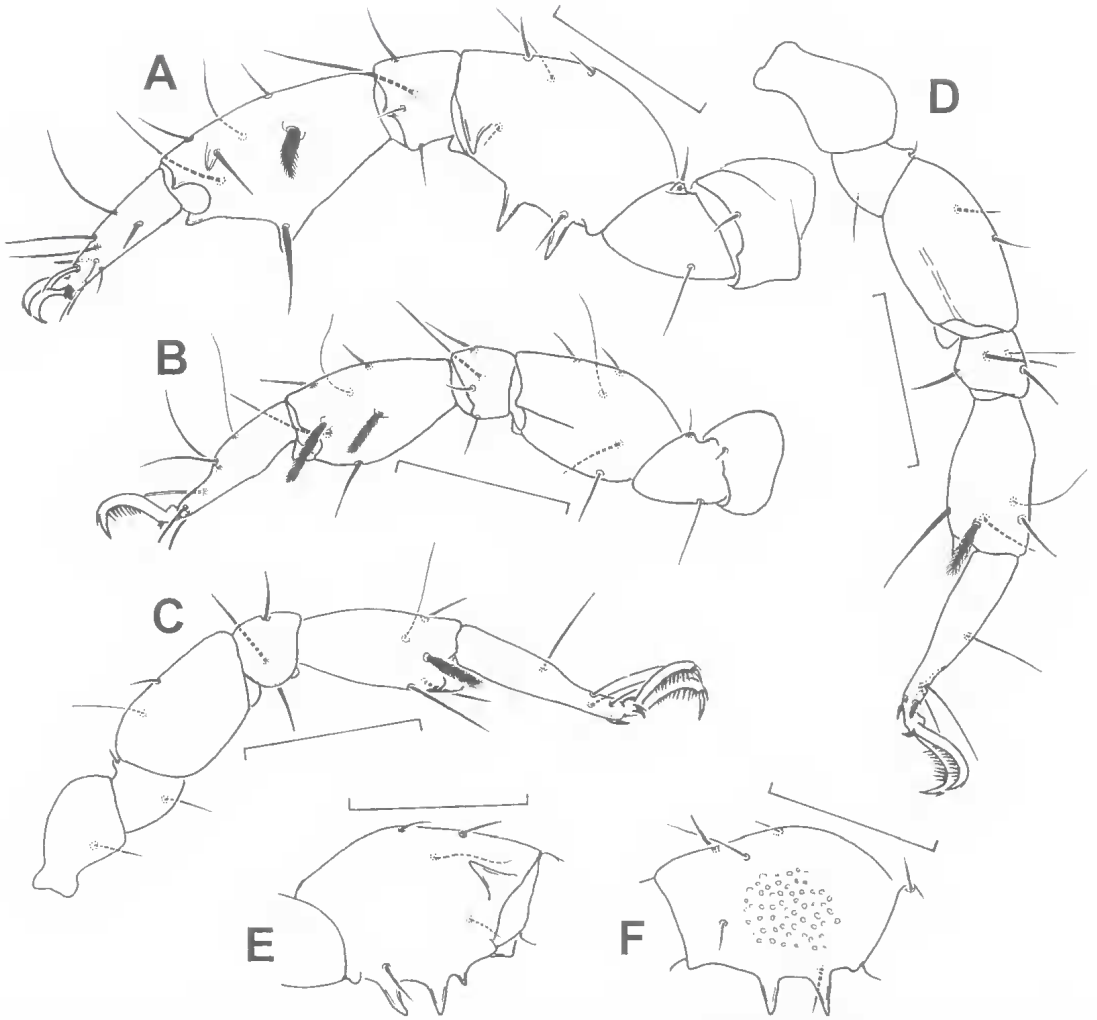

FIG. 8. *Copidognathus hawaiiensis* Bartsch, ♀; A, leg I, ventromedial view; B, leg II, medial view; C, leg III, ventromedial view; D, leg IV ventromedial view; E, telofemur I, medial view; F, telofemur I, lateral view. Scale bars: A-F = 50μm.

towards posterior, at level of glp-3 ca. 4-5 rosette pores wide; reticulation between costae barely visible; glp-3 and glp-4 associated with medial costae; ds-4 in posterior half of plate. AE with concave posterior margin (Fig. 9B). PE in anterior half with broad band of pits and underlying canaliculi extending from about the inner-most seta to the anterior-most seta or the anterolateral rosette pore areola; posterior to leg IV insertions with canaliculi. Male with ca. 24-27 perigenital setae. Female GA as in Fig. 9D. Gnathosoma as depicted in Fig. 9C. Ventrolateral lamellae on telofemora poorly developed, with smooth edges (Fig. 10A-C,E). Tibia IV with one bipectinate seta. Bipectinate seta on tibia I distinctly more robust than those on the other tibiae, and with coarser pectination; ventral seta on tibia I distinctly thickened and spine-like. Empodial claw on all tarsi clearly visible. Paired claws of tarsus I smooth, those on tarsi II-IV with a short cluster of about 5-7 teeth that increase in size towards the distal end of the claw; cluster of teeth discontinuous with accessory process (Fig. 10D); paired claws II-IV conspicuously slender.

REMARKS. Among the species of the *ornatus* group *C. orarius* resembles most closely *C. umbonatus*. Both species can be distinguished by the morphology of the tarsal claws. *Copidognathus orarius* has maximally 7 tines on each claw II-IV, and this short row of tines does not

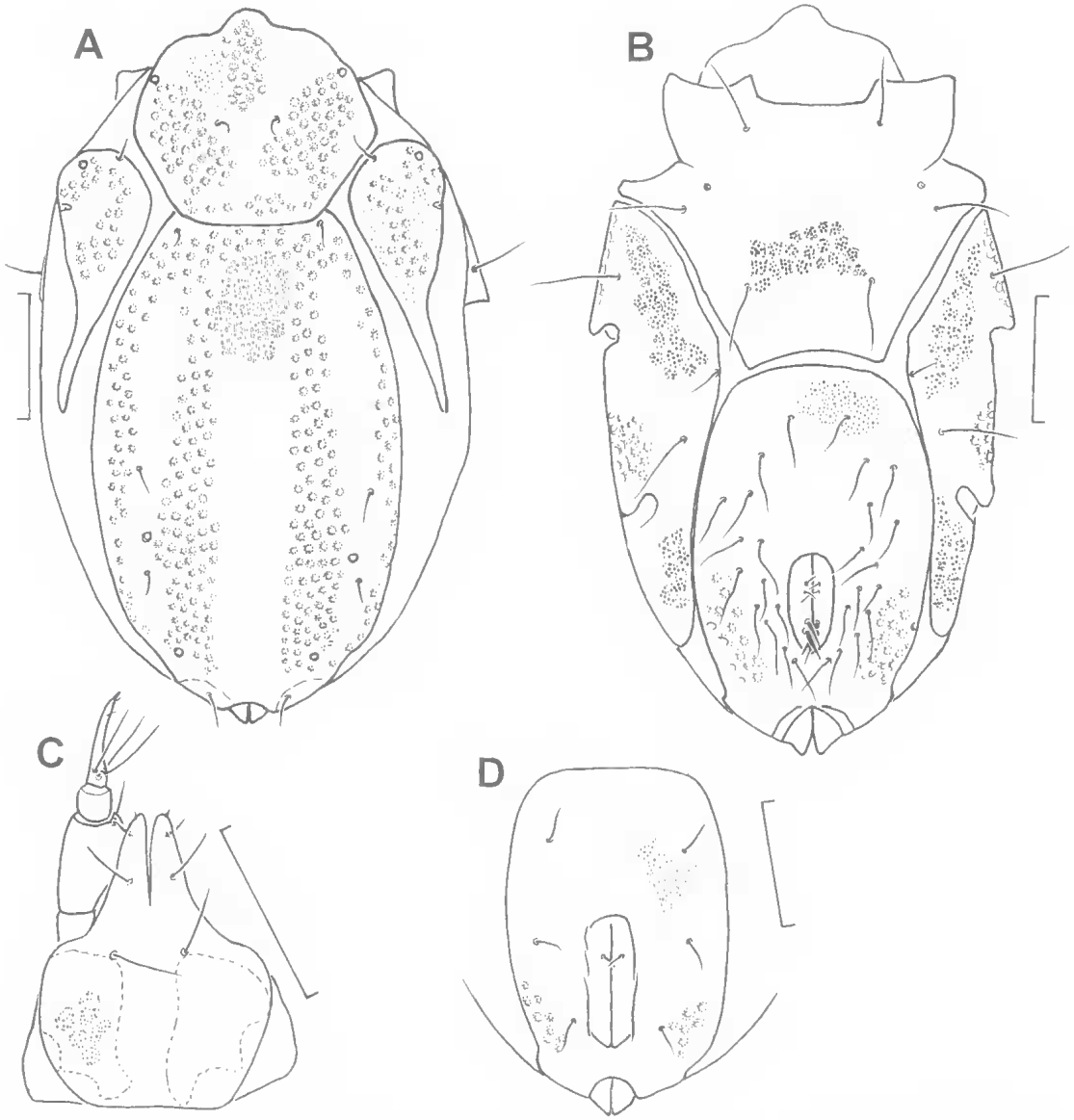

FIG. 9. *Copidognathus orarius* sp. nov.; A, ♀, idiosoma, dorsal view; B, ♂, idiosoma, ventral view; C, ♀, gnathosoma, ventral view; D, ♀, genitoanal plate. Scale bars: A-D = 50μm.

conneet to the inconspicuous accessory process. By contrast, in *C. umbonatus* each claw II-IV has at least 12 tines and this row of tines extends along the entire apical half of the claw and merges into the accessory process.

Copidognathus ornatus Bartsch, 1981

Copidognathus ornatus Bartsch, 1981: 58.

MATERIAL: QMS105730 (1 ♂), Great Barrier Reef, Whitsunday Islands, Long Island, ca. 20°23'S 148°52'E, 28 Feb. 1997, sand & coral rubble at 0.5m

The 352μm long specimen agrees in all aspects under examination with the holotype of *C. ornatus* from the Moçambique Channel. *C. ornatus* can be distinguished from all other species in the *ornatus* group by having 2 glabrous ventral setae on tibiae IV, instead of one bipectinate and one glabrous seta that are present in all other species.

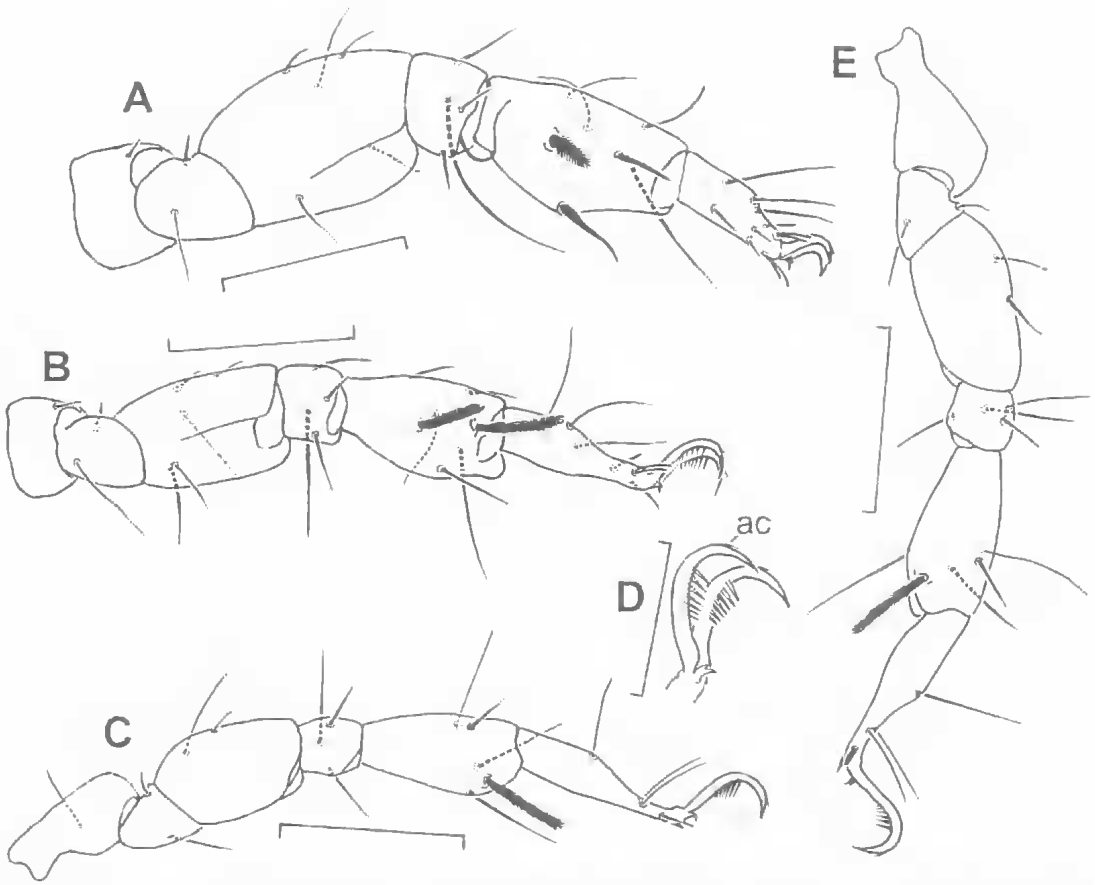

FIG. 10. *Copidognathus orarius* sp. nov.; A, ♀, leg I, ventromedial view; B, ♀, leg II, ventromedal view; C, ♀, leg III, medial view; D, ♂, detail of claws on tarsus IV, ventromedial view; E, ♀, leg IV medial view. Abbreviation: ac, accessory process. Scale bars: A-C,E = 50μm; D = 25μm.

Copidognathus prideauxae sp. nov.
(Figs 11,12)

ETYMOLOGY. For my friend, the late Anne Teresa Prideaux Payne.

MATERIAL. HOLOTYPE: QMS105746, ♂, Great Barrier Reef, No Name Reef, ca. 14°39'S 145°40'E, 9 Oct. 1998, medium coarse sand at 6m. PARATYPE: QMS105747 (1 ♂), data as for holotype.

DESCRIPTION. *Male*. Idiosoma 320-352μm (holotype 320μm) long. AD with posterior areolae not extending to glp-1 (Fig. 11A); along posterior margin with band of rosette pores. OC with medial areola consisting of at least 13 rosette pores which in holotype and paratype show a gap posteriorly. PD with both medial costae appearing clearly separated when focussing onto the canaliculi in deeper cuticular layers but appearing connected through a band of shallow pits on the surface of the plate; medial costa about 2-3, lateral costa 1-2 rosette pores wide; between costae with reticulated ornamentation becoming fainter towards posterior; glp-3 and glp-4 associated with the medial costa; ds-4 about half way along plate. AE with concave posterior margin (Fig. 11B). PE with extensive and conspicuous band of canaliculi extending from near the inner-most seta to the anterior areola; similar canaliculi posterior to insertions of leg IV. GA with 27-33 perigenital setae. Gnathosoma (Fig. 11C). Ventrolateral lamella on telofemora with smooth or slightly undulate edge (Fig. 12A-D). Tibia I without ventrolateral cuticular protrusion. Tibia IV with bipectinate seta. Bipectinate seta on tarsus I as finely pectinate as those on other tibiae. Tarsi III and IV with 4 dorsal setae. Paired claws legs II-IV coarsely pectinate (Fig. 12E). Empodial claws on tarsi II-IV barely visible under oil immersion.

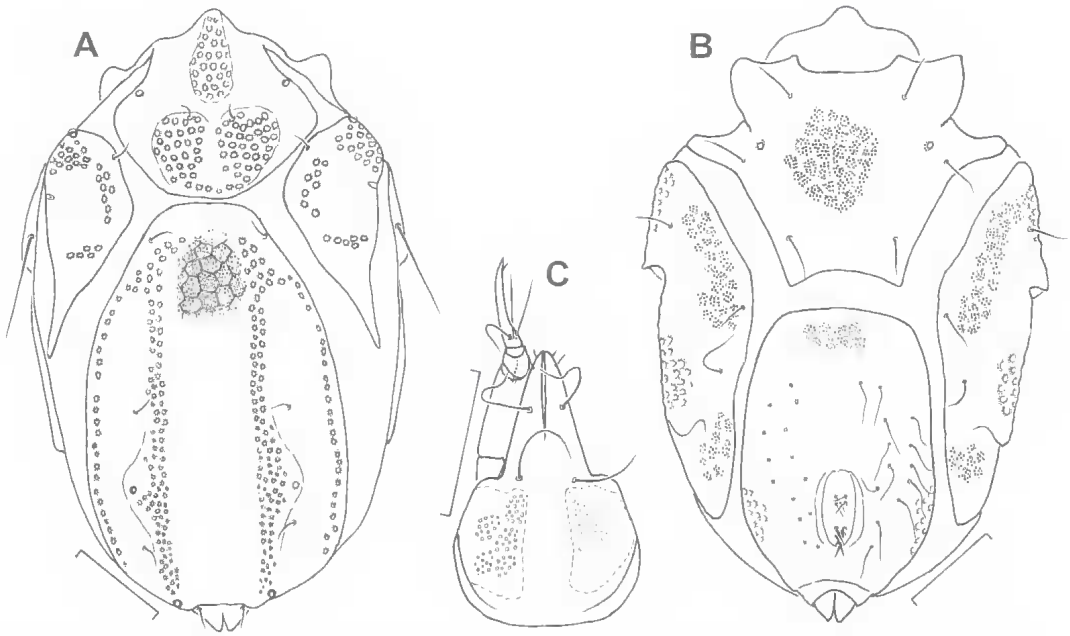

FIG. 11. *Copidognathus prideauxae* sp. nov., ♂; A, idiosoma, dorsal view; B, idiosoma, ventral view; C, gnathosoma, ventral view. Scale bars: A-C = 50μm.

REMARKS. The only other species of the *ornatus* group with 4 setae on tarsi III and IV and similarly coarse pecten on tarsal claws II-IV is *C. ornatus* (my observation on the holotype). *C. prideauxae* differs from *C. ornatus* by having a bipectinate seta on tibia IV.

KEY TO SPECIES OF THE *COPIDOGNATHUS ORNATUS* GROUP

1. . Ventrolateral lamella on telofemur I transformed into at least 2 large spines (Fig. 8A,F); tibia I with a ventral protuberance that is associated with a seta (Fig. 8a) . . 2

   Ventrolateral lamella on telofemur I either smooth or slightly undulated (Fig. 2A), not transformed into 2 conspicuous spines; tibia I without a ventral protuberance that is associated with a seta 3

2. Ventrolateral lamella on telofemur I transformed into 2 large spines, or 2 large and one much smaller spine; glp-3 in lateral areolae, more lateral than ds-5 . . . . . *C. hawaiiensis* Bartsch

   Ventrolateral lamella on telofemur I transformed into more than 3 spines; glp-3 on outer edge of medial areola and directly anterior to ds-5 . . . . . *C. acanthoscelus* Bartsch

3. Tarsi III and IV each with 3 dorsal setae 4

   Tarsi III and IV each with 4 dorsal setae 5

4. Paired claws on tarsi II-IV each with a short row of 5-7 teeth that is discontinuous with the accessory process . . . . . *C. orarius* sp. nov.

   Paired claws on tarsi II-IV with a row of at least 12 teeth that is continuous with the accessory process . . . . . *C. umbonatus* Bartsch

5. PD without lateral costae bearing rosette pores; medial areola on OC consisting of 2-5 rosette pores . . . . . *C. barrierensis* sp. nov.

   PD with lateral costae bearing rosette pores; medial areola on OC consisting of at least eight rosette pores . 6

6. Tibia IV with a bipectinate seta (Fig. 2D). 7

   Tihia IV without a bipectinate seta . . *C. ornatus* Bartsch

7. Paired claws on tarsi II-IV with teeth that increase in size towards the distal end of the claw. *C. prideauxae* sp. nov.

   Paired claws on tarsi II-IV finely pectinate throughout, pectines not increasing in size towards distal end of claw 8

8. PE with a broad band of canaliculi arising from the anterolateral areola on the PE and reaching to about the innermost seta; posterior to leg IV insertion with several groups of canaliculi. . . . . *C. emblematus* sp. nov.

   PE with canaliculi near the innermost seta but not in form of a band that reaches the anterolateral areola; posterior to leg IV without canaliculi. . . . . *C. adonis* sp. nov.

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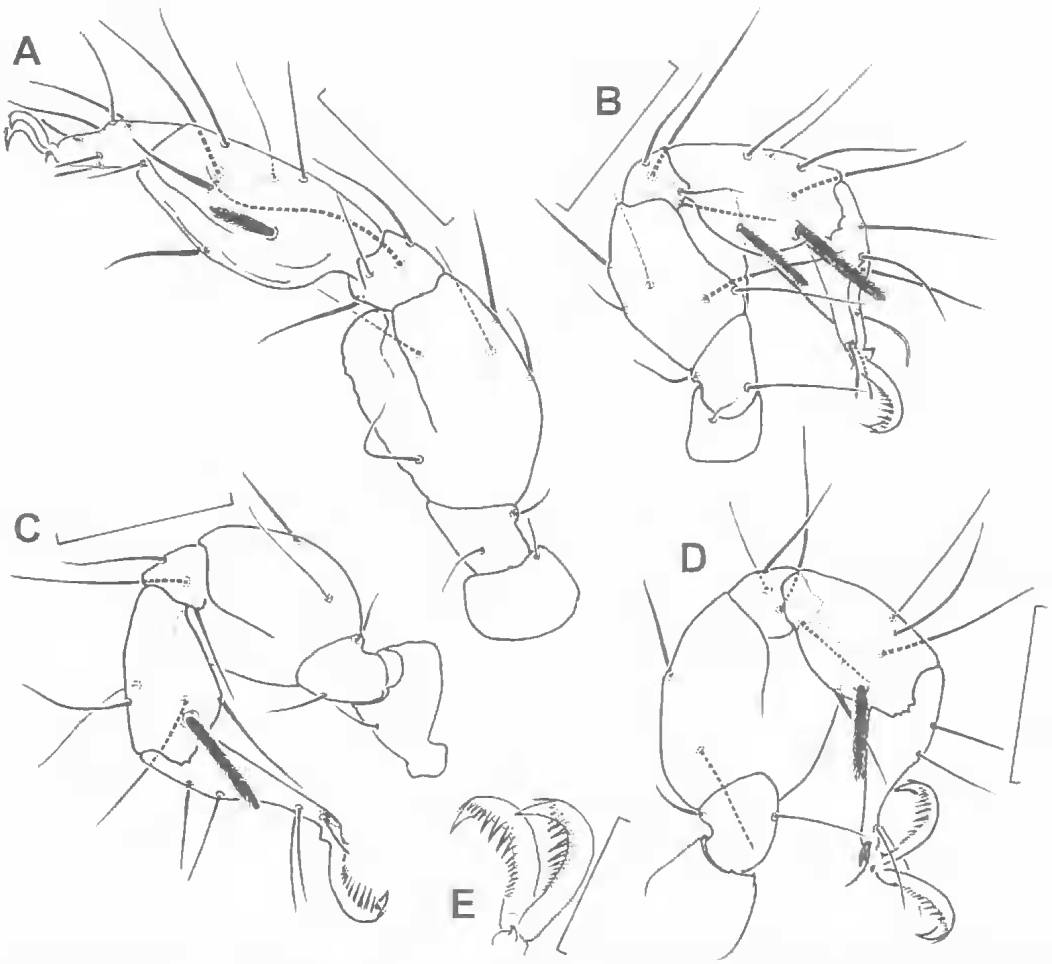

FIG. 12. *Copidognathus prideauxae* sp. nov., ♂; A, leg I, medial view; B, leg II, medial view; C, leg III, medial view; D, leg IV, medial view; E, detail of claws on tarsus II, ventral view. Scale bars: A-D = 50μm; E = 25μm.

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